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## Rotating piston machine

Description

The present invention relates to a machine with the revolving piston, which encloses workspaces with alternately changing volume such as: compressors, pumps, or engines where the piston is arranged inside the cylinder formed by two sidewalls and the curved covering, the curve of which is a geometrical locality of the piston cusps arising during its revolving motion around two revolving axes.

There are known arrangements where the piston a simple revolving motion holds. It is eccentrically placed inside the circular covering equipped by the extension seals, which fill changing distances between the piston and the circular covering and concurrently enclose changing workspaces between the piston and the cylinder covering. This arrangement does not tolerate high pressure or temperature therefore it can only be used as a blower. Furthermore, there are known arrangements where the piston holds one compound revolving motion i. e. rolling motion (by rolling a bigger circle, for example the central circle of the inside tooth-wheel, over an immobile smaller circle for example the central circle of the tooth-wheel with an external gearing, by means of the tooth-wheels). The diameters ratio of both circles quantifies the number of the piston cusps, which follows the same curve and also the same number of workspaces enclosed by the piston. If the ratio is 2:1, the piston has two cusps and encloses two workspaces. If the ratio is 3:2, the piston has three cusps and encloses three workspaces, etc. The advantage of this

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arrangement consists in that the covering curve can be formed as a geometric curve of the piston vertex, so that the extension seals provided in the heads of the piston fill a small and nearly constant space between the piston vertex and the covering. At the higher number than two of the piston cusps, the covering curve has very inconvenient shape for a combustion space and in addition the biggest-the smallest volume ratio of the workspace is principally restricted, which is the disadvantage of this solution. In consequence of that and in regard of the practical experience the arrangement of this kind is not suitable for the combustion engines. Two cusps arrangement can else provide more convenient combustion space and more convenient the biggest-the smallest workspace ratio, but also principally gives the adverse ratio of piston surface encumbered by work pressure to the biggest possible critical shaft diameter, which the piston is embedded on. This arrangement is therefore not suitable for engines, but only for blowers or pumps and low work pressure compressors.

The present invention seeks to eliminate the disadvantages of the current state of technology by a machine with the revolving piston embedded in the cylinder. This machine is characterised by the fact that the piston in the cylinder is mounted both in the revolving way pivoted around two mutually parallel axes perpendicular to the side cylinder walls and in the sliding way in two directions perpendicular both to each other and also to the parallel axes of rotation. Another characteristic of the invention is that the machine is provided with two parallel shafts of rotation being provided in the direction perpendicular to the rotation axes with the guiding members, e.g. pins, on which the piston is mounted in the sliding way by means of sliding members, e.g. bushes.

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Another characteristic of the invention is that the guiding shaft is mounted in the cylinder wall in the sliding way in a direction of the plane interlaid with the rotation axes. Another attribute of the invention is that the piston is mounted on the supporting eccentric connected with the supporting shaft, which (the eccentric) is mounted in the revolving way in pivoted on the minimum one cylinder side wall in parallel with the piston rotation axes and between these axes, while the eccentricity of the supporting eccentric is equal to one half ( $1/2$ ) of the distance between the rotation axes. The invention is moreover characterised by the fact that at least one of the guiding shafts is created as the guiding ring mounted in the revolving way in pivoted on the lateral side and provided on its front side facing the piston with the guiding members, e.g. grooves or projections, which the sliding members, e.g. grooves or projections, connected with the piston are mounted on. Another characteristic of the invention is that the guiding ring is provided on its front face averted from the piston with the additional, auxiliary guiding members arranged/laid out perpendicularly to the guiding members on the side facing the piston and in which the gliding pin mounted in the revolving way / pivoted on the guiding eccentric fitted on the supporting shaft in parallel with the supporting eccentric and turned by 180 degrees is arranged/designed. Another attribute of the invention is that the spaces in-between the sliding members, e.g. pins or projections on the one side and the guiding members, e.g. bushes or grooves, on the other side are enclosed and provided with holes for the lubricant inlet and outlet.

The invention can be seen closely on the attached drawings, where Fig. 1 is a scheme of the machine according to this

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invention and Fig. 2 shows the principle of the conchoid design. Fig. 3 shows another design of the machine where the piston is conducted by the conducting rings and is furthermore embedded on the supporting eccentric, which is connected to the supporting shaft. Fig. 4 and Fig. 5 show schematically and Fig. 6 in section other variations of the invention.

On Fig. 1, the piston 2 equipped by the slots 3, 4, which form the sliding elements of the piston 2 is arranged in the curved casing 1. The slots 3, 4 settle the piston 2 on two conducting elements 5, 6, which are always fixed upon one of the shafts 71, 81 whose axes are parallel. According to Fig. 2 the cylinder casing 1 is enclosed by the sidewalls 11, which shafts 71, 81 are rotary embedded on. Arrangements of the sliding elements 3, 4 and the conducting elements 5, 6 (at the opposite sides of the piston) and the shafts 71, 81 show Fig. 4 and 5. During the revolving of one of the shafts 71, 81, the fixed conducting element 5, 6, which furthermore revolves the piston through the particular sliding element, e.g. slot, concurrently revolves too. The piston also revolves around the axes 8, 7 through its second sliding element 4, 3, the second conducting element 6, 5 and the second shaft 81, 71. When the cusps the same distance from the centre of the piston 2 have, then both of them follow the same covering curve, which forms together with the connection line of both of the cusps two separated spaces.

The concurrent revolving motion of the piston 2 around the parallel axes 7, 8 causes that during the motion along the covering 1 one of the joins of the piston 2 departs from the covering 1, while the other join approaches the covering 1. During revolving shafts by 360 degrees and thus turning the

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piston by 90 degrees, the space between one join of the piston cusp and the covering 1 amplifies from minimum to maximum while the space between the second join diminishes from maximum to minimum. When the cylinder covering 1 and/or the cylinder sidewall 11 are equipped at one side by an inlet and at the opposite side by an exhaust of the liquid or fluent medium, then this medium begins by revolving of just one of the shafts to suck into the space between the covering 1 and the piston 2 at one side and to suck out of this space at the other side. The machine then works as a compressor or a pump. If a pressure medium is fed through at one side of the cylinder into the space between covering 1 and piston 2 then the pressure on the surface restricted by the join of the cusps and the width of the piston 1 causes force, which eludes the revolving axis 7 and causes a moment to this axis. This moment revolves the shaft 71 and thereby also revolves the piston 2 and the second shaft 81.

The distance of the parallel axes 7, 8 of the shafts 71, 81 of the arrangement according to the invention can vary continuously in the plane comprising both parallel axes 7, 8, even during the run of the machine. Obviously, the shaft 81 has to be pivoted only in one degree of the freedom in the side wall 11 of the piston, whereas the piston 2 is supported on the approximating lines between the culmination points and movable in a perpendicular direction. The piston 2 is pivoted towards the other shaft 71 in the direction of his culmination points whereas the shaft 71 can be pivoted in the side wall 11 in two degrees of the freedom, i.e. in rotation and sliding in the plane of both axes 7, 8 according to the Fig. 2. By variation of the distance between both axes 7, 8 can be changed fluently, during a machine run, both the ratio of

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minimal-maximal space between the cusps join and curved covering (thereby also the volume of the sucked or expanded and blown medium) and the magnitude of the moment to the revolving axis 7. In case of at least two in series connected machines according to the invention (for example one as a pump and second as an engine powered by fluent or liquid medium) the movement of at least shaft 71 towards the shaft 81 causes a change of the rotational speed as well as the ratio of the moments of both connected machines. According to the arrangement as described above, the shaft 71 is loaded by a force defined by the pressure applied to the piston 2.

According to another characteristic of the invention, the said load can be diminished by providing of at least one of the conducting shafts 71, 81 as a hollow shaft, namely as the conducting ring 72, 82 pivoted in the side wall 11 and equipped with a conducting element 51, 61, which is connected with a sliding element 31, 41 in the piston 2. The piston 2 itself is pivoted e.g. through a bearing on the supporting eccentric 10 arranged on the supporting shaft 91 rotary embedded at least in one of the sidewalls 11.

The supporting shaft 91 passes through the conducting rings 72, 82 and its axis lies on the plane formed by axes 7, 8 of the conducting rings 72, 82 in the middle distance between them. Eccentricity of the supporting eccentric 10 is equal to the middle distance between axes 7, 8. Within the revolution of the piston 2 conducted by the conducting rings 72, 82 the centre of the supporting eccentric 10 moves along the same trajectory as the centre of the piston 2. Piston 2 loading is then fully transmitted by the supporting eccentric 10 and by the supporting shaft 91, so the conducting rings 72, 82 are

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not under the load of piston pressure. There can be transmitted high piston pressures according to the concept shown on the Fig. 3. The conducting ring 72, however, cannot be shifted like the conducting shaft 71 of the arrangement according to the Fig. 2.

According to the invention, the conveniences of both arrangements can be used in a combination, consisting in that only the conducting ring 82 is used and the conducting shaft 71 is supported in both side walls 11 and projects through the conducting ring 82. In this case, the supporting shaft 91 or the eccentric 10 can not be used. Piston loading is then transmitted by the sufficiently dimensioned and both sides embedded shaft 71.

At the concept with the supporting eccentric 10 and the supporting shaft 91, there is, according to the other invention character, a connected function of both of the conducting rings so that ,the conducting ring 72, 82 is arranged just at one side of the piston 2 and adapted according to the Fig. 6 so that, aside from the conducting element 51, 61, arranged at the inclined cylinder side, it has, along the disinclined cylinder side, ancillary conducting element 52, 62, which the glide rotary set on the ancillary eccentric 15 is in the sliding way embedded in. This ancillary eccentric 15 has the same eccentricity as the supporting eccentric 10 and it is firmly arranged on the supporting shaft 91, which is rotated by 180° against the supporting eccentric 10. In this way, both of the conducting rings can be jointed into the one from both of the embedded sites. It is clearly seen that from manufacturing reasons, it is more convenient to place the jointed conducting ring on the

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place of the conducting ring 82 i.e., so the conducting element 61 would be embedded in the sliding element 41 of the piston 2, in a sliding way, perpendicularly to the line joining both of the pistons 2 cusps.

All machines with moving components have many places, which are necessary to lubricate or to cool. At the machine, according to the invention, it is not necessary to use a separate pump, because it is possible to use, according to the particular character of the invention, changing spaces between some mutually moving parts (e.g. between sliding elements 3, 4, 31, 41, or optionally between the glide 14 and the conducting elements 5, 6, 51, 61, 52, 62 as a pump for a lubricating and/or cooling medium by means of closing these spaces at the sides so that they provide inlet and exhaust vents for the above mentioned medium. In this manner, not only the usual expensive and heavy pumps can be excluded, but this lubricating, or/and cooling medium can be during pumping inside the machine conducted through places to be cooled, or/and lubricated so that the consumption of these mediums is very small.

The invention is, both according to the design examples and also to other designs resulted from the patent requirements, more convenient, comparing to the known piston engines, by its smaller size as compared with engines with sliding pistons, smaller weight and is totally balanceable. It is more powerful and less noisy comparing to the toothed machines. It has a lower noise, better ratio between the maximum and the minimum sizes of the working space, lesser consumption of the lubricating medium. At the machine, according to the invention, there is not a direct dependence of the piston diameter on the loaded area of the piston, which enables a



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utilization under high pressure e.g. in the case of combustion engines, or in the case of very high pressure at hydraulic pumps.